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(Extended Abstract)

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ABSTRACT

In recent trends, the mechanism of coping, a psychological mechanism that consists of expending conscious effort to respond to the significance of events, is incorporated in Affective Intelligent Agents to deal with negative situations, usually signaled by strong negative emotions. In this paper, we propose to adopt Roseman's coping theory to model emotional coping in an intelligent agent that appraises situations based on its goals and values. In particular, coping strategies for negative moral emotions affect the moral dimension of the agent.

Categories and Subject Descriptors

I.2.m [**ARTIFICIAL INTELLIGENCE**]: Miscellaneous; I.2.1 [**ARTIFICIAL INTELLIGENCE**]: Knowledge Representation Formalisms and Methods

General Terms

Languages, Theory

Keywords

Emotions; Affective Agents; Virtual Agents; Coping

1. INTRODUCTION

Given their importance for human behavior, emotions have attracted the attention of scholars who attempt to create models of intelligent agents, as surveyed by [4, 6]. A fundamental contribution of emotions to human behavior is given by the mechanism of coping [5, 3], intended as a set of strategies that people put to use to deal with stressful situations, usually signaled by negative emotions such as fear or shame. Given their usefulness, coping mechanisms have been integrated into computational models of emotions [6, 4]. Coping allows agents to deal with strong negative emotions by manipulating their cognitive states in a way that changes their appraisal of the situation and affects their behavior.

In recent years, coping strategies have been integrated into computational models of emotions with methodologies that range from agent modeling [6, 4] to logic formalization [1].

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Most computational models follow Lazarus's theory [5] of coping and the taxonomy of coping strategies proposed by Carver et al. [3]. Broadly speaking, coping is encoded into intelligent agents as a process that affects the agent's interpretation of the situation by manipulating its beliefs and goals (e.g., changing the importance of goals [6, 4, 1] and its expectations about the outcomes of actions [6], dropping intentions [6, 4]). In this paper, we propose a coping mechanism for moral emotions based on Roseman's coping theory [8] and we integrate it in a moral emotional agent model [2]. Differently from previous theories, Roseman's theory specifies coping strategies that are specific to negative moral emotions and affect the agent's moral dimension and behavior through the notion of *emotivational goals*. Our coping mechanism affects not only goals but also the moral values of the agent, changing their importance or motivating the agent's will of being compliant with its moral values via emotion-specific *emotivational goals*.

2. THE COPING MODEL

As anticipated in the previous section, we deal with the coping of events that negatively affect the agent's goals and values (i.e., Distress, Fear, Shame, Reproach, Remorse and Anger), i.e., they are are "motive inconsistent" in Roseman's terms. These emotions include both primitive moral emotions (Shame and Reproach), rooted in value compliance, and goal-based emotions (Fear and Distress), needed to model compound emotions (Remorse and Anger). Fig. 1 summarizes the strategies that we implemented for the following emotions: Fear, Distress, Shame, Reproach, Anger and Remorse. All strategies are related to taking distance from the negative stimulus. Fear and Distress motivate the agent to take distance from its own goals and plans that have caused the negative emotions, while moral emotions (Shame, Remorse, Reproach, Anger) are characterized by taking distance from one' s own moral values that have caused the negative emotions.

Distress: an agent feels Distress when one of its goals has failed, so it reduces the importance of the failed goal g_i (i.e., it takes distance from the goal) in order to decrease the intensity of the negative emotion and the probability of selecting the goal during the next deliberation phase.

Fear: the agent feels Fear when its current plan π^t has a low probability of success. If this is the case, continuing executing the plan would be a waste of energy and time, so "taking distance" from the stimulus is realized by dropping the plan.

Emotions	Coping activation conditions	Coping effects
Distress	An agent's goal has failed	Lower the desire importance of failure
Fear	The current plan has a low probability of success	Drop the plan
Shame	Self-caused: the active plan puts at stake a value v_i	Lower the value priority, continue performing the current plan. Ignore the threat to the moral dimension
Reproach	Other-caused: a value is put at stake by an action performed by another $agent_i$	Create goal increaseSocialDistance($agent_i$)
Anger	A value v_i is at stake and one of adopted goal g_j is unachievable	Create goal (increaseSocialDistance($agent_i$) $\wedge$ reEstablish(g_j))
Remorse	A value v_i is at stake and a goal g_j is unachievable	Create goal (reEstablish(v_i) $\wedge$ reEstablish(g_j))

Figure 1: Coping strategies implemented for negative moral emotions, inspired by Roseman's theory.

Shame: when the agent performs an action that puts at stake one of its values, the agent feels Shame. The coping strategy of Shame consists in taking distance from its moral dimension, so that the agent lowers the importance of the value at stake v_i in order to reduce the intensity of the negative emotion.

Reproach: when an agent's value v_i is at stake (and the responsibility is attributed to another agent's action), the agent feels Reproach toward the agent a_x who performed the blameworthy action. According to Roseman [8], the agent takes distance from the agent who performed blameworthy actions by lowering its contact with it. Differently from other coping strategies, this strategy is inherently social, since it affects the relation between self and other. So, we model this coping strategy through the goal of increasing social distance ($increaseSocialDistance(a_x, v_i)$) from the agent who performed the blameworthy action (thus putting the value at stake). This goal motivates actions that aim to signal the non-compliance with value.

Anger: when another agent performs an action that causes the failure of an agent's adopted goal g_j and puts an agent's value v_i at stake, the agent feels Anger. In response to Anger, the agent forms the goal ($increaseSocialDistance(a_x$,-$v_i), reEstablish(g_j)$). The adoption condition of the goal of asserting blame is the conjunction of two conditions, i.e. that the agent a_x performed the blameworthy action and that the value v_i is at stake as the consequence of this action.

Remorse: when an agent performs an action that causes the failure of one of its own adopted goal g_j and puts one of its own values v_i at stake, the agent feels Remorse. So, the agent creates the goals ($reEstablish(v_i), reEstablish(g_j)$) with the aim of bringing the value at stake back to balance and re-establishing the conditions for adopting the failed goal.

3. DISCUSSION AND CONCLUSION

In this proposal, we sketched a computational model of emotion-focused coping for moral emotions inspired by Roseman's theory of coping. In our proposal, Roseman's coping strategies are translated into rules that affect the mental state of the artificial agent, by modifying its goals and values, or asserting new moral goals when the inconsistency cannot be solved by a simple manipulation of the agent's motivational and moral components. The current model has some important limitations and needs to be improved and extended: for example it does not take into account the interaction of coping with the social relations of the agent. An integration of the model presented in [7], where the authors present a formal model of social relations, may help solving this problem. A social component would also be beneficial to modulate the role of values on their shared priority.

As future work, we envisage the implementation of the model in an practical agent architecture and its evaluation of a wider range of scenarios. The implementation in an agent architecture should deal with the balance between the modification of goals and values implied by coping and the stability of agent's behavior implied by the persistence of intentions.

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